

PROJECT NOTE

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SUBJECT: Jard Company, Inc.

TASK DESCRIPTION: Surficial Geologic Interpretation for the Jard Company, Inc. Site

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This project note outlines the interpreted conclusions made based on the surficial geologic history of the Jard Company, Inc. (Jard) site area and observations documented during recent subsurface soil boring and well installation activities. Below are statements which are presented within the Jard HRS Documentation Record, and the materials that support the conclusions which were drawn. Note, that the reference numbers refer to references listed in the HRS Documentation Record.

**Statements/Conclusions:**

*The Pleistocene glacial sequence in the Bennington area indicates conditions conducive to till deposition, followed by lacustrine deposits, which were overtopped by fluvial deposits upon breakup of the lake formations.*

- [91, pp. 56-57] From data collected during the recent survey, the following Pleistocene sequence, in chronological order, can be deduced for the Vermont region.
  - I. A possible pre-Bennington glacial state with glaciation from the northwest followed by a lake episode and erosion. The evidence for this glacial interval is too scant, too scattered and too indefinite at this time. It is merely noted in this sequence so that the possibility can be subsequently discussed in this report.
  - II. The Bennington Glacial Stade
    - A. Glaciation from the northwest that covered all of Vermont and probably all of New England. (During this survey it has been found as far south as Williamstown and Charlemont in Massachusetts and east to New Hampton in New Hampshire.
    - B. Probable lake episode in the Champlain Lowland, Connecticut River valley and Vermont Valley as the Bennington ice waned.
  - III. The West Norwich Interstade
    - A. Weathering and erosion of the Bennington Till
  - IV. The Shelburne Glacial Stade
    - A. Glaciation from the northeast that covered all of Vermont with the exception of the extreme southern part.
    - B. Deposition of dense basal till in some localities and loose, sandy ablation till over wide areas.
    - C. Ice-marginal, high-level lakes formed in the eastward-flowing tributaries of the Connecticut River as the Shelburne ice melted down from the high lands to the west.
    - D. Ice-marginal lakes in the Manchester-Bennington region of the Vermont Valley
- [91, pp. 61-62] The earliest proven glaciation of Vermont was an invasion of glacial ice across the region from a northwest direction. This glacial episode covered all of Vermont and probably all of New England...

The till deposited by the Bennington glacier has been identified in all section of Vermont except in the northwest part...

The only section where the Bennington drift is exposed as the surface is a small area in the extreme southern part between Bennington and Brattleboro...

The Bennington till is a dense basal till which has been overridden by subsequent glaciation except in the small area where it forms the surface till....

- [91, pp. 68-70] As the Bennington ice receded from the Bennington region, a lake formed in the Hoosic River valley. Taylor first noted a lake in this area at an elevation of 1,100 feet which he named Lake Hoosic. Later he changed the name to Lake Bascom...The lake was dammed by ice in the Hudson River valley and drained southward through Massachusetts.

The well-developed lacustrine sediments deposited in Lake Bascom are conclusive evidence of a lake episode.

- [91, pp. 70-71] The intermediate drift in Vermont has been designated the Shelburne from exposures near the village of Shelburne where it was first studied. The deposits of this glacial episode were made by ice that traversed the region from a northeast direction. The Shelburne glaciers covered all of Vermont with the possible exception of an area between Bennington and Brattleboro along the southern boundary of the state...
- [91, pp. 95-97] When the margin of Shelburne ice stood at or near its terminal position in the Bennington area a large lake developed in essentially the same area as that of Lake Bascom, but at a lower level, during the retreat of the Bennington glacier. The lake, designated Lake Shaftsbury with an outlet at Patter Hill, New York, was in existence until the Shelburne ice deposited the Hale Mountain Moraine...After the ice waned from the Hale Mountain Moraine, Lake Shaftsbury drained completely.
- [94, pp. 1-2] The reference indicates that the site area is underlain by outwash which is described as horizontally bedded glaciofluvial gravel, Spillway or valley train gravel in stream valleys, may or may not have a thin veneer or postglacial alluvium.

The reference also indicates that the site area contained drift sheets of the Bennington Drift and that high level lakes probably dammed by Bennington Ice were present over the site area.

Based on the above information and my geologic interpretation, the site area was first overlain by the Bennington drift, depositing basal till on top of the bedrock surface. Following the ice retreat in the Bennington area, a glacial lake (Lake Bascom) formed, which most likely deposited lacio-lacuastine sediments on top of the basal till. Following drainage of glacial Lake Bascom, horizontally bedded glaciofluvial gravel, Spillway or valley train gravel outwash sediments were laid down over the glacio-lacustrine sediments.

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*Based on limited soil boring activities, it appears that bedrock in the area of the Jard property is overlain by basal or lodgement till which may form a confining layer.*

- See above for Pleistocene glacial history and interpretation.
- [91, p. 25] In Vermont few frontal (terminal and recessional) moraines are found. Most areas of till therefore may be described as ground moraine inasmuch as the till was deposited directly by glacial ice. The surface expression, however, is not the depositional topography of a ground moraine, except in scattered local areas, but is everywhere a reflection of the irregular surface of the underlying bedrock.
- [91, p. 26] There are two distinctly different kinds of till in Vermont. One is a loosely packed, very sandy till containing angular boulders of local bedrock, and the other is a compact till containing more rounded, striated boulders with a higher content of erratics. The loose sandy till is designated ablation till in this report as the term has been used by Lee (1957). The compact till is called basal till.

- [91, p. 26] The material that is designated basal till in this report is a dense, compact till that varies in color and texture with the incorporation of local bedrock. It is often blue-grey in color when unweathered, but in some areas it is dark grey to black and in others it is buff to brown.
- [3; 88, p. 22] The location of monitoring well EPA-107 is close to a slight topographic high which is most likely indicative of bedrock surface topography (see above).
- [31, p. 44] A thin layer of basal till is believed to be present above the dolomite. This till is likely a dense, heterogeneous, poorly sorted, clay-rich deposit with fractures present in it.
- [88, pp. 22, 161-162] Boring log for ground water monitoring well EPA-107 indicates surficial descriptions from 20 to 28.5 feet that contain a major fraction of silt with fines plastered or pasted on the gravels present. In addition, the relative density of the material was noted as hard.
- [88, pp. 22, 161-162] Boring log for ground water monitoring well EPA-107 indicates that the material at the bottom of the boring was very hard and dry when broken.
- [116, p. 2] A confining layer is a layer of sediment or rock which has a low permeability. It does not allow water to easily pass through it, so it can protect the water beneath it from contamination.

Based on the above information and my geologic interpretation, the material most likely present within the bottom of boring EPA-107 was a basal till based on the presence of plastered fine materials and its relative density. Since basal tills are often described in this manner, its presence is indicative of materials overlying the bedrock surface. The appearance of dry material may suggest that the till may form a confining layer between the overburden aquifer and the bedrock below.

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*The lodgment till present in the area of the Jard property is overlain by glacio-lacustrine fine sands, silts, and clays.*

- See above for justification of the lodgement till and conditions favorable to glacio-lacustrine sediments.
- [65, pp. 17-18] In the deeper borings, a layer of silty clay to clay was found at depths of 29.5 to 32.5 ft bgs. In all deeper borings, an abrupt transition from sand to silt or clay was noted at this depth; below this transition, the material became progressively finer, with concomitant increases in material plasticity and durability.
- [65, pp. 53-55, 66-80] Two cross section interpretations based on completed borings suggest a layer of clayey silt or silty clay layer in the lower sections of some deep borings. See pages 73, 74, 78, and 80.
- [88, pp. 22, 145-165] Boring logs completed on and around the Jard site indicate layers of fine materials (fine sands, silts, and clays) at the bottom of some borings. These consist mainly of brown and gray silt, brown very fine sand, and brown and gray clay. Cross laminations were not observed in the lacustrine sediments encountered.

Based on the above information and my geologic interpretation, material most likely derived from a glacio-lacustrine environment is present in the area of the Jard site. This material is described as the bottom unit in most overburden borings completed in the area, suggesting widespread uniformity in its deposition. In most cases the bottom of the lacustrine sediments was not encountered.

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*The glacio-lacustrine sediments in the area of the Jard property are overlain by glacio-fluvial outwash deposits consisting of gravel, cobbles, and boulders with minor amounts of sand. In addition, the steep gradient/high velocity deposition within the valley area of the Jard site is exhibited in these deposits encountered during boring activities.*

- [94, pp. 1-2] The reference indicates that the site area is underlain by outwash which is described as horizontally bedded glacio-fluvial gravel, Spillway or valley train gravel in stream valleys, may or may not have a thin veneer or postglacial alluvium.
- [91, p. 35] The valley lakes, however, did not always conform to the standard description of slack-water bodies. Down-valley currents were often active even when a lake occupied the valley. In most cases, the earlier lakes were the highest, and the lake level was subsequently lowered. A great amount of water and sediment was carried into the lake by tributary streams.
- [91, p. 36] The mountain streams, because of steep gradient and high velocities, carried a wide range of different sizes of fragments including large boulders. The larger fragments are not conspicuous in the foreset beds inasmuch as they either drop out before the delta is reached or they roll to the bottom of the foreset slope.
- [91, pp. 42-43] The term spillway is used in this report to refer to streams beyond the ice margin that carried meltwater and sediment away from the terminus. These streams, because of the amount of water and sediment they carried, must have been most effective erosion agents. Many of the major stream courses were occupied by lake waters during early stages of deglaciation.
- [65, pp. 17, 52-54, 66-80] Multiple drilling attempts were necessary to reach the targeted depths at several locations due to the presence of large cobbles and boulders in the subsurface...  
The Site and surrounding area considered in this investigation are underlain predominantly by poorly sorted glacial drift to a depth of 29.5 to 32.5 feet, at which an apparent confining layer was encountered (sandy silt, silty clay, and/or clay).  
This surficial layer is underlain by the aforementioned poorly sorted glacial drift. Grain-size in the drift ranges from trace silt and clay to cobbles and boulders. Sand occurs throughout, ranging in size from fine to coarse. The cobbles are a massive, vitreous, white or pink to buff colored quartzite. Granular structure and bedding planes are visible in the larger stones. Some gravel pieces are clearly angular pieces of larger cobbles, and some pieces were fractured with pressure applied by hand. The sand appears to be predominantly of same material as the gravel and cobbles, and is found mostly as the matrix between larger grains, although several sand lenses of various grain size and thickness are noted at different depths. The material is generally poorly sorted, with occurrences of cobbles and trace silt found throughout the drift layer.  
Two cross section interpretations based on completed borings suggest a uniform distribution of gravel and cobble containing material
- [88, pp. 22, 145-165] Materials encountered during boring activities on and around the Jard site indicated a layer of gravel, cobbles, and boulders. This layer consisted of poorly sorted gravel, cobbles, and boulders (white, pink, tan, buff, and black quartzite and metamorphic rock fragments), fine-to-coarse sand, and silt.

Based on the above information and my geologic interpretation, the area around the Jard site is underlain by outwash materials that were most likely deposited during the latter stages of glacial lake occupation. These glacio-fluvial area deposits are highlighted by unsorted materials including gravel, boulders, and cobbles.